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Vol. 15.]

DECEMBER, 1944.

[No. 4.]

# AGRICULTURAL JOURNAL



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1944.

## FORMER ISSUES OF AGRICULTURAL JOURNAL.

### NOTES FOR LIBRARIES AND RESEARCH INSTITUTES.

So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues is given for reference. Attention is directed especially to Volume VII which had only one part:—

Vol.		Vol.
1.	3 numbers, 1928	8. 4 numbers, 1935-7
2.	4 " 1929	9. 4 " 1938
3.	3 " 1930	10. 4 " 1939
4.	4 " 1931	11. 4 " 1940
5.	2 " 1932	12. 4 " 1941
6.	2 " 1933	13. 4 " 1942
7.	1 number, 1934	14. 4 " 1943

### ISSUES OF THE AGRICULTURAL CIRCULAR.

THE following were the numbers and year of issue of the *Agricultural Circular*:—

Vol. 1, 1920, 12 numbers.	Vol. 4, 1923, 1 number.
" 2, 1921, 5 "	" 5, 1924-5, 2 numbers.
" 3, 1922, 4 "	

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, Part 1.

### OLD ISSUES OF AGRICULTURAL BULLETINS.

FREE copies of the following Bulletins are available to Colonial Departments of Agriculture, research institutes and bona fide planters, etc.:—

- No.
1. Sisal Hemp in Fiji, 1911.
  3. Rhinoceros Beetle in Samoa, 1912.
  4. The Banana in Fiji, 1912.
  5. Scale Insect on Bananas, 1913.
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  11. Alluvial Soils of Fiji, 1919.
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  14. Transparent Coconut Scale, 1921.
  15. Purple Leaf Moth of Coconuts, 1924.
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  22. An Introduction to the Mosquitoes of Fiji, 1943.
- Fijian Plant Names, 1942. Price 3s. 6d., 4s. and 6s.

Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

—EDITOR.

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ERRATA—Vo. 15, No. 3, Sept., 1944:—

Contents, for page 80 read page 79.

Page 78, antepenultimate paragraph for "Caun"  
read Caum.



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# AGRICULTURAL JOURNAL

ISSUED BY THE  
DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 15.]

DECEMBER, 1944

[No. 4

## EDITORIAL.

### SOIL SURVEYS, RURAL LAND-USE PLANNING, AND RURAL LAND CLASSIFICATION.

IN certain quarters both administrative and technical confusion exists as to the meaning of the terms soil survey and rural land classification, so much so that both terms are considered to be synonymous.

A soil survey involves the study of soils in relation to climate and natural vegetation and has as its objective a strictly scientific classification of the soils of a climatic region in accordance with the principles of the science of pedology. As a result of such a classification information is immediately available as to the probable agricultural worth of the soils under study from experience gained with similar soils in other regions.

For the purpose of land-use planning the data secured in the soil survey are mapped in terms of the soil series or type depending on the detail of the survey.

In Fiji for example we possess climatic and vegetative conditions which should relate our soils at maturity to the tropical red loam and lateritic groups. It is important that we should know something about the maturity of our soils and their degree of lateritisation in order that we may know: (1) what to expect under certain types of treatment, (2) how to manage the soils satisfactorily and (3) what special measures should be adopted to minimise erosion tendencies.

The practical application of the soil survey usually takes the form of some system of land classification. At the moment there are at least three such systems and the generally accepted one is that developed by the United States Bureau of Soil Science. A recent addition to the list is a system developed in the West Indies by Dr. Chenery working in co-operation with Professor Hardy of the Tropical School of Agriculture, Trinidad. The late Geoffrey Milne, one of the foremost soil scientists of the Colonial Service, has reported on the new scheme and considered that it had much to commend it and might be of general utility.

In the American system of rural land classification the basic data are the soil types defined by the soil survey together with the consideration of factors of importance in land-use such as relief, stoniness, natural vegetation, etc. An analysis of the external characteristics of soil type give rise to the natural land type which can be further classified in terms of productivity for specific crops and in accordance with the use dictated by present economic conditions and trends. A generalisation of this data leads to an agricultural rating of the soil.



Rural land-use planning is an administrative matter of first importance since by forethought and planning many of the evils such as erosion, exhaustion and, in milder cases, lowered fertility are avoided. It is the duty of Government to formulate policies and programmes in order that land usage will conform to a pattern dictated by soil properties and agricultural economics of concern to the community as a whole. It is the duty of established authority to advise and, under certain conditions, dictate what lands shall be opened up for agriculture or grazing and the type of crop and management to be adopted in order to limit erosion, reduce pest and weed incidence and in consequence maintain fertility. The ultimate objective is to strike a balance between agriculture and grazing on the one hand and forestry on the other in order to meet the needs of the community in terms of cash and sound nutrition and at the same time conserve soil in areas subject to erosion.

It is not possible here to discuss in detail the many factors, both physical and economic, which are taken account of in a policy directed to planned land-use. The basic physical data are secured from the soil survey and the land classification map is a synthesis of this data with the results of agricultural experience, experiment and a consideration of internal and external economics. There is thus provided for administrative authority a broad picture of land utilization.

Soil surveys are expensive and results are usually not immediately obvious with the result that progress in soil classification has been slow. Particularly has this been so in the Colonial Empire and in consequence land utilization has been based on empirical principles rather than the intrinsic scientific properties of the soil.

In recent years administrative authority has become more aware of the grave results attending wrongful land utilization, particularly where population pressure is forcing marginal lands into agricultural service. This feature is becoming apparent in Fiji and in the short period of fifteen years erosion has become a paramount problem in several closely-settled areas of Viti Levu.

—W.J.B.

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#### DEPARTMENTAL NOTES.

THE period that has elapsed since the publication of the last number of the *Journal* has been a busy one for the officers of the Department both at headquarters and in the districts.

Of first importance has been the visit to the Colony of Professor Shephard of the Imperial College of Tropical Agriculture, Trinidad, and his report on the sugar position is awaited by the Department with as much interest as the agricultural community to which it more directly pertains.

Of immediate concern to the Department and to the agricultural community as a whole are the findings of Professor Shephard on the organization and policy of the Department of Agriculture. The recommendations contained in his report, which is now available, will be studied with great interest by those who are concerned with the agricultural problems of the Colony.

Professor Shephard made many visits to departmental headquarters and in his tour of the Colony visited district agricultural headquarters and experiment stations. In discussion with departmental staff, both singly and collectively, planters, graziers and farmers, Professor Shephard in his direct and friendly manner secured a wealth of information concerning agricultural conditions as they exist in the Colony to-day.

Another important visitor to the Department was Dr. Harman, a senior executive of the Colonial Sugar Refining Company. Dr. Harman has had a distinguished chemical career and is well known in sugar circles. His comments on agricultural and industrial trends in Australia were much appreciated by departmental officers whose duties during the war period have prevented them from maintaining contacts with agricultural workers in other countries.

In 1939, with the appointment of the Senior Agricultural Officer and the return of the Senior Chemist from 18 month's study leave in the United States, opportunity was taken to form a departmental committee for the purpose of drawing up a programme of agricultural research and investigations. This report coincided with the completion of essential construction work at the newly established Sigatoka Experiment Station. With the onset of war in September, 1939, the major portion of the plan was deferred and investigations in operation were one by one abandoned in the face of increasing pressure on staff and available land for foodstuffs in connexion with the "grow more food" policy.

Recently, as a result of changing conditions, the Committee was asked by the Acting Director to review the former programme and submit proposals for agricultural investigations in line with the needs of the Colony and in keeping with proposals for post war reconstruction. The Committee, consisting of the Senior Chemist (chairman), the Senior Veterinary Officer, the Senior Agricultural Officer, Government Entomologist and Agricultural Officer Southern met on four occasions and submitted a report for consideration.

The study of agricultural statistics as a basis for sound planning is a matter of first importance and one that has been engaging the attention of departmental officers during recent years. It has been stated that statistics can be manipulated to give all sorts of impressions many of which are false. This statement is true if the data are scanty and are not collected in accordance with approved and uniform systems. The Department possesses much information of value in respect of certain crops and stock and during the past two seasons has conducted seasonal surveys of rice plantings. Detailed information is now being sought as to plantings of other crops by Indian and Fijian farmers, especially food crops and bananas. Already much interesting information is available, but for security reasons the publication of planting and production data is not permitted. In normal times the publication of planted acreages of crops, particularly annual and short term crops such as maize, rice, tobacco, bananas, etc., would be of considerable value to producers, traders and consumers.

Despite a depleted staff, due to leave and sickness, all efforts have been made by headquarters and field officers to visit farming areas. Recently the Acting Senior Veterinary Officer completed a tour of the North-Western and Western Division, and the Acting Director of Agriculture has paid a visit to agricultural stations and centres in the South-Western and Western Districts.

The transfer of the Agricultural Officer Northern to Suva for rice duties in connexion with supply and production is a necessity of general importance to the Colony. This transfer is of a temporary nature only and will operate until such time as the rice position improves. Northern District Agricultural matters will be taken care of at headquarters by the Agricultural Officer Northern.



The Entomologist, Mr. R. J. A. W. Lever, is spending two months interim leave including five weeks at Cawthron Institute, Nelson, New Zealand, where he proposes to become acquainted at first hand with recent work on the biological control of weeds.

The Senior Veterinary Officer, Mr. Charles Turbet, is spending a well earned rest in New Zealand and Australia after an unbroken tour of five years including a three month's secondment in the Solomon Islands. The Agricultural Officer (rice), Mr. Harwood, and the Stock Inspector Northern, Mr. Gardiner, are at present on leave in Australia and New Zealand respectively.

We are happy to report that Stock Inspector C. Koster has returned to duty after his recent illness and Assistant Agricultural Officer J. Suckling is fast on the mend.

It is with regret that we record the resignation through ill health of Field Assistant Waisaka Kedraika. —W.J.B.

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### PLANT INTRODUCTION 1933-1943.

By

B. E. V. PARHAM, M.A.  
Agricultural Officer South.

DURING the past ten years the Department of Agriculture has given a great deal of attention to the introduction and acclimatization of economic and ornamental plant species—many of which have been successfully established at Agricultural stations and demonstration farms. The Director (Dr. H. W. Jack) early on instituted a world wide inquiry for useful plants—some of the more interesting of which are listed in the present record. It is mainly due to his constant efforts that so many introductions have been possible.

The work of plant introduction and acclimatization involves many problems which are not usually apparent to the general public. There is a great deal more in this than merely ordering seeds from a plant list or catalogue and then when they arrive sowing them and waiting for them to grow.

Attention must be given to the selection of varieties of proved worth—to the conditions necessary to their proper health and growth—to season and to methods of packing and transport to ensure them arriving in a sound condition. The seeds of many valuable plants are often viable for a short period only—others need special treatment before they will germinate—some plants can only be raised vegetatively either by cuttings, bulbs or buds. In the former case particular care must be taken and often transport by air arranged—in the latter case it may take weeks if not months to air dry the corms, bulbs, etc., so that they can be mailed or shipped without fear of decays and rots affecting them.

At the receiving end proper facilities must be established for the quarantining of plant material—for its propagation under suitable conditions of soil and climate and for its subsequent distribution. A great deal of care must be taken with records of plant introductions to ensure that the original varieties are not lost or confused. Under modern agricultural and horticultural practice most economic plants have been studied for the selection of desirable characteristics and almost every species of cultivated plant has a great many varieties. It is absolutely essential that all varieties for trial be properly labelled to avoid confusion not only during the preliminary



period of establishment and trial but during the whole of the time of propagation for distribution. However obvious such steps may be—their proper execution calls for great care and patience over extended periods.

Special methods such as those described in connexion with the establishment of Soya bean or Lucerne must be studied and put into practice.

Conditions in Fiji are often adverse to this kind of work—storms and floods not infrequently interfering with the programme or in some cases ruining it altogether and necessitating a new start being made. The ultimate aim of Departmental action is of course, to make available to farmers, schools, and the general public new varieties of crop and garden plants of proved worth with as little delay as possible.

Finally it may be mentioned that in Fiji plant introduction and acclimatization represents an extremely small part of the Departmental programme and has always been carried on as a subsidiary project at one or other of the agricultural stations without the assistance of special staff or funds.

#### DRUGS. I—MEDICINAL.

The experimental introduction of plant species of medicinal use has always received attention but was further encouraged in 1940 at the request of the British Empire Drug Council.

1. *Datura* (*D. metel*, *D. stramonium* and others).—Certain species of *Datura* occur locally; and as a start seed of *D. metel* var was collected by the writer and plots established. From these plants seed was obtained and forwarded to New Zealand where the Department of Scientific and Industrial Research had established a special experimental station for the testing and propagation of drug plants.

The writer visited this station in 1943 to find the Fiji material giving excellent results in the field. Seed of the following varieties was obtained and introduced successfully at Naduruloulou:

<i>Datura metel</i> (Purple var):	<i>D. stramonium</i> var.	a—prostrate.
do. (White var):	„ var.	b—English strain.
	„ var.	c—Tall upright.

2. Castor oil (*Ricinus communis*).—The medicinal properties of this oil are well known—it is also valuable as a lubricant; and war-time demands appeared to justify an attempt to introduce and propagate superior varieties to that already naturalized locally. The latter is one of the small seeded types and grows not uncommonly on the coastal-belt in Nadroga and on the alluvial flats of the Rewa river and its tributaries.

In March 1943 the writer brought seed of two varieties from New Zealand and these have been established successfully—the yield of seeds being reasonably good. Chemical work on the yield of oil is pending.

3. *Hydnocarpus wightianus* and *H. anthelmentica*.—Seeds of these two species were introduced about 1930 and trees were first established at Nasinu, Naduruloulou, Sigatoka and also at Makogai where the oil esters are extracted for use in the treatment of leprosy.

Both species have been successfully established but the former is to be found in greater numbers owing to the distribution having been mainly from Naduruloulou.

A great many seedlings have been issued to schools and individuals during recent years and large numbers of seedlings are being raised to meet the present demand as a result of recent appeals for increased supplies of the product.

4. Fennel (*Foeniculum vulgare* Mill).—This plant was grown successfully from seed introduced in 1943 and is still under trial.

5. Cardamoms (*Elettaria cardamomum* Maton)—were successfully introduced during 1939 but the plants were destroyed subsequently by storms.

6. Ipecacuanha (*Cephaelis ipecacuanha* Rich).—Plants of this valuable species introduced in 1938 were carefully tended at Nasinu but failed to become established.

7. Cinchona (*C. succirubra* and *C. ledgeriana*).—Seed of these two species—the natural source of the important drug Quinine has been imported several times from Kenya and elsewhere. Unfortunately although specially protected beds were prepared for the seed—no germination was recorded—and owing to war conditions efforts to establish this crop locally have had to be postponed.

#### DRUGS. II—INSECTICIDES.

1. Pyrethrum (*P. cinariaefolium* Chrysanthemum).—The dried flowers of this plant are well known locally in the form of "Banana Powder"—used for the protection of banana fruits from the ravages of the Scab moth (*Nacoleia octosema*).

Several trials were made to establish this valuable plant but without success.

In 1935 seed received from the Scott Laboratories, Department of Agriculture Kenya produced five plants which were carefully raised—but which died out in the summer 1936–37 without having flowered.

In March 1937 the writer brought specially selected seeds and plants from the Plant Research Station, Palmerston North, New Zealand. These had been grown there by E. E. Chamberlain Plant Pathologist from seed originally introduced from Nairobi. The germination results were good and a large number of plants were planted out in the field and grew reasonably well for several months but during the hot moist weather of the summer 1937–38 succumbed to *Sclerotium* rot of the crown. These trials forced the conclusion that the climate of the low lands is too hot for this plant but there were indications that it might succeed at higher elevations as at Nadarivatu. Unfortunately at the time no facilities for trials at higher levels were available.

2. Turkestan Tobacco (*Nicotiana rustica* and var *sparata*).—The value of the alkaloid Nicotine extracted from the leaves and stems of Tobacco plants as a contact insecticide is well known.

As the nicotine content of Turkestan tobacco is much higher (6–15 per cent) than that of ordinary tobacco (*N. tabaccum*)—3–7 per cent—and as Nicotine compounds are comparatively expensive—the writer obtained seed of the former species from New Zealand in 1937 and several plots were established at Naduruloulou—where the plants grew excellently for several years.

3. *Derris elliptica*.—Cuttings of the Malayan selection Changi No. 3 were received in 1936 and after a period of quarantine planted out at agricultural stations where they have grown well. Many distributions have been made.

A more recent introduction of a strain from Amani established at General Experimental Station Sigatoka in 1940 has proved to contain a higher yield per cent of the active principle rotenone; and its propagation is being speeded up so that material may be available for distribution at the earliest possible date.

#### FIBRE PLANTS.

1. N.Z. Flax (*Phormium tenax*).—In 1937 the writer introduced seed of this useful plant with a view to its being tried out for control of erosion in the upper reaches of Fiji rivers and streams. This seed failed to germinate.



In 1943 by courtesy of the Director Botanical Gardens Christchurch, seed of *P. tenax* (Red var.) and of *P. Colensoi* were obtained and sown at Naduruloulou. Germination was fair but most of the young plants were destroyed by an over zealous agricultural student who mistook them for grass during weeding operations. At the present time a few plants are growing and making slow progress.

2. Chinese Hemp or Ramie fibre (*Boehmeria nivea* Gaud.).—In October 1940 seed of this plant was introduced from Australia and a plot established at Naduruloulou—where it grew fairly well. This species now occurs as an escape from cultivation in one or two localities. It is the source of a valuable bast fibre—and interest in it was recently stimulated by the formation of a Company in Australia which claimed to have perfected a means of extracting the fibre.

3. Monserrat Cotton (*Gossypium* sp. var.).—Seeds from London in 1937 failed to germinate.

4. Manilla Hemp (*Musa textilis* and vars.).—In 1939 corms of three varieties of this extremely valuable fibre plant were received from Malaya—viz. (1) *Musa textilis*, (2) Var. Tanganon and (3) var. "Bungulnon"—These were successfully raised at Central Agricultural Station Naduruloulou but were found susceptible to the Virus disease "Bunchy Top".

The work of propagation has thereby been hampered and is proceeding slowly.

5. *Hibiscus sabdariffa* Linn. var. *altissima* (Patwa).—Excellent stands of this plant have been grown and it is of interest to record that Indian farmers in the Tonga district have established plots and have made from the fibre an excellent quality rope—the softness and strength of which makes it most suitable for use on the farm.

6. *Linum usitatissimum* Linn (Linseed or Flax).—Attempts to grow this valuable crop were made on several occasion at Sigatoka and Naduruloulou but results were not very satisfactory. The plants grew a short straw but failed to set seed.

7. Sunn or San Hemp (*Crotalaria juncea*).—This plant which is also useful as a fodder or green manure has been grown with satisfactory results. It was found to be subject to infestation by the larvæ of *Utethesia* and gave better results in the dry zone.

8. Panama Hat Plant (*Carludovica palmata*).—Although not a recent introduction this plant was found among local ornamental plants under the name—"Japanese Palm" and has been established at Naduruloulou where it grows luxuriantly.

9. Mase (*Broussonetia papyrifera*).—The Papermulberry is well known locally and in view of war time demands the Department has made a collection of available varieties from all parts of the Colony. These have been established for study and distribution to growers.

#### FODDER PLANTS AND GRASSES. I—*Legumes*.

1. Lucerne (*Medicago sativa* Linn.).—Several attempts have been made to establish this well known fodder plant—the most successful of this so far as the writer is aware, was that made in May 1937—with seed obtained from the Department of Agriculture, New Zealand.

Prior to sowing the seed was treated with the standard bacterial inoculum—and 80 per cent germination obtained. The plots grew very well during the cooler months and the plants attained a height of 30 to 36 inches with a correspondingly robust habit and were cut back several times.

The hot wet summer, however, had a very adverse effect and many of the plants suffered from Crown rots. It is clear that this crop requires a cooler climate and better drainage than that of the wet zone—where most of the dairy farms of the Colony are located.

2. *Desmanthus virgatus* ("Acuan").—Seed of this plant was introduced by the Director of Agriculture in 1935 from Hawaii. As it is not well known locally it may be mentioned that it has a good reputation as a fodder in that territory.

The introduction has been successful and plots are now established at Naduruloulou, Korovou and Waimaro (Tailevu) and Dobuilevu (Ra) and seed has been distributed to stock owners in various parts of the Colony. The plant stands the summer well, seeds freely and shows a tendency to spread without assistance. Its erect and somewhat woody habit may not be entirely advantageous but if grazing trials are satisfactory it may prove a valuable addition to the fodder plants, especially for use on poor soil.

3. *Stylosanthes guianensis* (Pencil grass, also known in Queensland as Stylo).

This most promising legume reached the Colony due to the enthusiasm of the late R. B. Howard who in November 1942 sent to the writer a packet of seed he had obtained from South Queensland. A small plot was established—the plants grew well and the high seed rate has enabled other plots to be established at Waimaro (Tailevu) where the growth on red clay soil is most promising. At the original site the plants seed freely and spread rapidly.

The prostrate habit of this species and its robust growth under local conditions during the past eighteen months justify the hope that it may prove one of the most valuable additions in recent years to the fodder plants of the Colony. In Australia it has been suggested that the name of this plant should for practical reasons be shortened to "Stylo"—It is a native of Brazil and the following notes are taken from recent Australian reports<sup>(10)</sup>.

The number of seeds per lb is approximately 120,000. Successful plantings can be made using cuttings six to eight inches long if put out at the commencement of the wet season. Seeding at from 1-4 lb per acre is suggested.

Feeding value is high and in grazing trials this legume has been readily consumed and is the most promising pasture component to date in North Queensland: it is aggressive and able to withstand successfully heavy rainfall and relatively dry conditions. It flourishes on the red soils of the Innisfail area, particularly on well drained hillsides and thrives on acid soils.

McTaggart <sup>(11)</sup> says of this legume—"because of its adaptation to the northern half of Queensland, its ability to provide productive, rich and palatable pasture practically the year round, its natural regenerating capacity, its suitability to light soils, its drought resisting quality, its capacity to combine with grasses, its apparent ease of establishment in existing swards and its capability of assuming the role of Lucerne under tropical conditions bid fair to supply a long-felt want, namely, that of providing a legume for northern pastures of low protein content by reason of their natural deficiency in legumes."

4. *Centrosema pubescens* ("Centro").—Seeds received from Malaya in 1936 and from R. B. Howard in 1940 have enabled the establishment of this useful legume at various places where it is now almost naturalized.

Number of seeds per lb is approximately 15,000—seed rate 5-6 lb per acre. Palatability is recorded as good and the stand is semi-permanent<sup>(12)</sup>.



This and the two following plants are twining herbs which tend to form a dense cover.

5. *Calopogonium muconoides* ("Calopo").—Introduced first in 1936 from Malaya this is a vigorous creeping herb which provides a valuable cover which is usually mixed with one or other of the other legumes. The number of seeds per lb is approximately 33,000—Seed rate 3-4 lb per acre is recommended.

6. *Pueraria phaseoloides* Benth. ("Puero").—Seeds received from R. B. Howard in 1943. The growth of this legume is very rapid. It is readily taken by cattle. The number of seeds per lb is approximately 37,000 and the seed rate 3-4 lb per acre. It may also be propagated by cuttings.

## II—GRASSES.

Amongst grasses may be listed the following species all received through the courtesy of the late R. B. Howard in 1943.

1. *Urochloa tricuspidata*, *U. pullulans*, *Chloris distichophylla* *Panicum antidotale*, *P. Marikarikensis*, *Cenchrus ciliaris*.—Although fair germination was recorded, none of these survived the summer weather conditions.

2. *Urochloa panicoides* received in 1941 from Toowoomba, Queensland showed some promise but was unable to hold its own with local grass species in the field and failed to become established.

3. *Melinis minutiflora* Beauv. (Molasses Grass) introduced successfully proved able to compete well with local weed growth with a little assistance and its free seeding habit and ability to spread indicated that for some areas it might prove useful. It has not proved popular with stock owners and only a few distributions have been made.

Other grasses introduced for trial in 1933 were fully reported upon at the time. Of these the most promising were weeping Love grass (*Eragrostis cruciata*) and Toowoomba Canary grass (*Phalaris tuberosa*) but neither of these have become established<sup>(1)</sup>.

4. *Paspalum notatum* (Bahia grass) was introduced by Mr. R. B. Howard and plants distributed to various localities. Although this grew well it appears to have disappeared from all stations except Navua.

5. In 1933 plants of *Spartina townshendii* received from New Zealand were planted out at Walu Bay and Rewa Estuary by H. R. Surridge but failed to become established<sup>(4)</sup>.

## FIELD CROPS.

1. Soya Bean (*Glycine Max* (Linn.) Merr.)—During the past ten years many trials of this extremely valuable plant have been made principally at the Central Agricultural Station Naduruloulou and the General Experimental Station, Sigatoka. Seed of a number of varieties has been introduced from Hawaii (1935), Malaya (1936), Queensland (1937), Burma (1938).

Of these one only, that from Malaya (Malayan No. 4), a strain originally selected and propagated there by Dr. H. W. Jack has proved successful.

The other varieties, viz. Easy Cook, Ootootan, Behrum, Black gave uncertain results, both as regards growth and yield.

The establishment of the yellow-seeded variety may be recorded briefly. From the original seed received at Naduruloulou only eleven plants were grown. These yielded less than eight ounces seed and when lifted from the soil only two plants were found to have developed bacteria nodules. From these a culture was prepared and the seed inoculated before sowing. The resultant crop of 1.5 acre was an excellent one—the plants attained a height of 54 inches and the yield of beans was heavy.

Distributions of seed have since been made to all parts of the Colony and a constant effort has been maintained to interest farmers in this crop.

2. Maize and Sweet Corn.—From time to time the Department has been instrumental in introducing to the Colony new strains of Corn. These are usually grown at the agricultural stations whence the seed is distributed to growers.

In 1937 the following varieties were introduced: Improved Yellow Dent, Golden Beauty, Star Leaming, Reid's Yellow Dent and Funk's 90-Day, all from the Department of Agriculture Brisbane, subsequently distributed.

In 1936 arrived a small quantity of tropical sweet corn seed—(U.S.D.A. 34) a variety resistant to leaf stripe disease—with a record for all the year round production. This has proved the best of many introductions for the wet-zone and has been widely grown by Indians and Fijian farmers in the Rewa River and Tailevu districts.

At Sigatoka the (4) variety "Trucker's Favourite" has been found most suitable and has been grown with great success.

3. Rice (*Oryza sativa*).—This crop has always had a major place in the programme and many varieties have been introduced and studied. Local strains also have been tested and selections made of the best for study and propagation.

Some of the work done has been recorded in the *Agricultural Journal* and in the Bulletin of Annual Reports of the Department.

Surridge (l.c. p.5) has reported on the varieties Sonacalif, Borneo and Motka—the former two being new introductions.

The present writer has recorded results obtained with the varieties B.G.75, B.G. 79, Ramcajara, Blue Stock, Demrara Creole D116—all high-yielding varieties introduced in 1932 from British Guiana (5, 6, 8).

Local selections of growing importance which have been propagated and distributed during recent years are "New Guinea".

Donald and Dass have recorded results of several varieties at Sigatoka.

In the Southern Division there has been a steady increase in the area planted to varieties distributed by the Department.

Of greatest interest are "Ramcajara" and "New Guinea". The former has become very popular with Indian farmers both on account of its good yield, and milling capacity and also accounts of its superior quality. In 1943-44 season 145 growers harvested 60 acres of this variety in the Southern Division.

The variety "New Guinea" was first grown in the Navua District and attracted attention on account of its good yield—and also of the facts that it may be grown out of season and that ratoon crops have given fair yield.

#### FRUIT.

1. *Passiflora* spp. (Passion fruit).—Seeds of the purple variety (*P. edulis*) from Queensland (1936) and of the yellow variety (*P. edulis flavicarpa*) from Hawaii (1933)—germinated well and many plants have been established and distributed. None of the Passion fruits bear well at low elevations in the wet zone (excepting the granadilla, *P. quadrangularis*) and their cultivation is not anywhere extensive.

2. *Anona* spp.—Seeds of Custard Apple from Queensland (1936) failed to germinate. This species is well established at Wakaya and elsewhere in the drier parts of the Colony but rare in Viti Levu.

3. *Achras sapota* L. (Sapodilla).—Seeds from Malaya (1937) failed to germinate. Two trees are at Nasinu.



4. *Citrus* spp.—In 1932 a consignment of budded *Citrus* trees was received from Trinidad. There were: Grapefruit (Duncan and Marsh seedless); oranges (Washington Navel, Jaffa, Valencia Late, Lue Gim Gong and Parson Brown) and the stock were all of Sour or Seville orange. These trees were planted at Nasinu and Central Agricultural Stations and have given good results<sup>(9)</sup>.

From them have been taken the budwood for the production of budded stock for distribution—many hundreds having been issued to-date.

In connexion with this work later introductions have been made of Trifoliate orange for experimental purposes but none of these have proved successful.

5. *Doryalis hebecarpa*.—In August 1942 seeds of this fruit tree were received from the Hon. T. W. Alport Barker, M.L.C. who had it originally from Honolulu. Two trees have been established.

6. *Coffea canephora*.—Seed from Amani in 1939 failed to germinate.

7. *Musa* spp. (Bananas).—Important introductions of Banana varieties have been made in recent years<sup>(7)</sup>.

In 1936 the following were received from the Imperial College of Tropical Agriculture—I.C.2; Giant Chinese; Congo; Lacatan and in 1939 from the Department of Agriculture Jamaica the hybrid S19. All of these have been established locally.

Seed of *Musa acuminata*, *M. basjoo*, *M. brachycarpa* and "Calcutta 4" were received in 1936. Of these only the first named germinated—and this species has now become established at Naduruloulou.

Other introductions of *Musa* species are dealt with under "Fibres", viz. Manilla Hemp.

8. *Carica* spp. (Pawpaw).—Repeated efforts have been made to introduce and establish new varieties of this fruit.

In 1939 were received from Kew Gardens seeds of the following *C. cauliflora* (Venezuela), *C. microcarpa* (Venezuela), *C. candamarcensis* (Columbia) and two other species unnamed from Colombia. The plants were successfully raised but were destroyed by hurricane before the fruits were sufficiently mature to enable seed to be extracted. It appears that only one, viz. *C. candamarcensis* was suitable to the local conditions of soil and climate.

In 1940 from Java came a new variety (unnamed) and from Malaya by courtesy of Sir M. Hedstrom came the varieties "Hawaiian Breakfast"; "Singapore" and "Red Java".

In 1941 seeds of the Solo Papaya were received from Hawaii through Mr. M. G. Williams and in 1943 the var "Mexicane" from New Guinea.

9. Brazil Nut (*Bertholletia excelsa*).—Seeds received from R. B. Howard, in 1944 failed to germinate.

10. Cashew Nut (*Anacardium occidentale* L.).—Introduced 1939 and established at Sigatoka, Ra and elsewhere. The trees have grown very well and yielded heavy crops of nuts.

11. Durian (*Durio zibethinus* Linn.).—Introduced in 1936—but does not appear to have been established.

12. *Lansium domesticum* Jack—"Langsat".—This and the following were introduced in 1939 and some trees have been planted out and are making slow progress.

13. *Nephelium lappaceum* Linn. "Rambutan".

14. *Olea europea* Linn. (Olive).—Seed imported 1939 failed to germinate.

15. *Poncirus trifoliata* Sw.—There are several records of the introduction of Trifoliate orange for use as a stock for Citrus budding. None appear to have survived.

## TREES.

1. Ceylon Ironwood (*Mesua ferrea*).—Seeds of this handsome tree were introduced by the Director of Forests in 1938 and seedlings made available to the Department of Agriculture have made good progress. The tree is described as "tall, broad, conical, slow-growing"—with large white flowers and deep crimson young leaves appearing twice a year rendering the tree a particularly handsome and conspicuous object.

2. Jacaranda (*Jacaranda mimosaffolia*).—When visiting Queensland in 1936 the writer arranged with the Director of the Brisbane Botanic gardens for a collection of economic and ornamental tree seedlings to be shipped to Fiji. Among these were some Jacaranda which together with those raised from seed obtained at the same time have added to the number of this species which already were in the Colony. Particularly suited for the dry zone, this beautiful tree is well worth the efforts being made to establish it in many parts of the Colony.

3. *Flindersia pubescens*.—Seedlings of this species were also received from Queensland in 1936 and a few trees have been established. This species has a good reputation in Australia for roadside planting.

4. Carapa.

5. Mahogany (*Swietenia macrophylla*).—Seed imported in 1936—good germination enabled several plots to be established on agricultural stations at Naduna (Waidina) Korovou and Waimaro (Tailevu) and Dobuilevu (Ra).

The tree has long been in the Colony and seed from local trees has been used recently to extend plantings.

6. Tung Oil (*Aleurites Fordii* and *A. montana*).—This tree was first introduced about 1930 and a few trees of *A. montana* established at General Experimental Station—Sigatoka. From these viable seed has been obtained.

Several other attempts have been made as follows:—Seed from Queensland Department of Agriculture in 1937 failed to germinate. In 1941 seed from Burma gave fair germination results and 60 trees were established. In the same year seed from Ceylon was not so good and 10 trees were planted out. These have all grown fairly well—but although they blossom freely, comparatively little fruit is set. Observations on individual trees are being made with a view to selecting the most prolific bearers for further propagation. Experiments in budding Tung oil on the local Candlenut (*Aleurites moluccana*) have been made and are continuing. Seed from Amani in 1939 produced only one tree.

7. *Casuarina equisetifolia* (She-oak or Iron-wood).—This well known tree is indigenous to the Colony; but in 1939 seed from India was introduced by the Conservator of Forests and some of the resulting plants made available for planting at agricultural stations.

8. *Macadamia ternifolia* (Queensland nut).—Seeds of the thin shelled variety of this valuable tree received in 1936 from the Department of Agriculture Queensland failed to germinate and to date no trees of this type have been established. A few trees of the thick-shelled type received from the Botanic Gardens Queensland at the same time have survived along with some of an earlier introduction about the year 1935. Local trees have fruited but the growth is not good and the yielding nuts poor.

9. *Acras zapota* (Chiku) from Java (1939) *Mammea americana* from British West Indies (1939) were sown but failed to germinate.

10. Coconuts (*Cocos nucifera*).—In 1939 Dr. Jack had sent from Malaya the following selected seed coconuts:—Malayan Dwarf Green—Nos. G139, G124, G125, G137, G142, G144. These were planted at Central Agricultural Station, Naduruloulou and have come into bearing.



11. *Areca catechu*.—In 1936 seed of a high yielding variety of this palm were received from Malaya. A number of seedlings were established and have grown well and borne heavy yields of excellent quality fruit. To date all of this has been utilized for propagation purposes.

12. *Muntingia calabura*.—The Department of Agriculture is indebted to Mr. Harrison W. Smith of Tahiti for seed of this fruit tree forwarded on several occasions. Unfortunately to date no germination has been obtained.

13. *Albizzia falcata* (Silver Bark Rain Tree).—This rapid growing timber tree has been successfully established at Waimaro (Tailevu) and elsewhere from seed introduced from Ceylon in 1936.

Trials of cases made of timber cut from trees five years old have been made with success and further plantings of the tree are regarded as justifiable owing to the local shortage of case timber.

14. *Yemane* (*Gmelina arborea*).—Seed imported from Malaya by the Director germinated well and resulted in the establishment of stands of this robust growing tree in various parts of Viti Levu. Growth is very rapid, trees at Naduruloulou five years old having attained a height of 50 feet and a girth of 44 inches three feet from the ground. This species would appear to deserve wide distribution in the Colony.

15. *Raphis* and other Palms.—In 1939 from Madagascar came seed of *Raphia raffia* the source of the material "Raffia"—and from Malaya seed of *Calamus*—one of the Malacca canes. From Nigeria came seed of the thin-shelled oil palm—but none of these germinated.

16. *Gliricidia sepia* (Madre de Cacao).—This very useful legume was introduced about 1930 and has become widely distributed through agricultural stations and demonstration areas where it is used as a hedge, wind-break and shade tree. Distribution has been mainly by means of cuttings as seeds are rarely set in the wet zone except in situations near the sea.

17. Tonka Bean (*Dipteryx odorata*).—One tree has been established at Naduruloulou. This is the source of "coumarin" "valued in perfumery and used in the preparation of sachet powders, scented soaps, tobacco, etc."

18. Gambier (*Uncaria gambier*).—Seed from Malaya in 1936 failed to germinate.

19. Redwood (*Sequoia sempervirens*).—Seedlings received in 1937 were planted at Naduruloulou and Nadarivatu but made poor growth for a few years and then died out.

20. Nutmeg (*Myristica fragrans*).—Nine seeds of this species received from Trinidad were sown in July 1939 but failed to germinate.

21. Kapok (*Ceiba pentandra* Gaertn. var. *orientale*).—Seed of the varieties *Bondonveso* and *Saigon* were received from Malaya in July 1935 and trees have been established at Naduruloulou, Waidina, Tailevu and Ra. From these trees there has been a steady distribution of seeds and seedlings to schools and individual farmers.

22. Balsa (*Ochroma lagopus*).—Introduced about 1939 by the Conservator of Forests—and seedlings made available by him have grown well the trees now being 50 feet high with trunks 32 inches in diameter.

23. Norfolk Island Pine (*Araucaria excelsa*).—A few trees have been planted out and have made slow progress.

24. West Indian Cedar (*Cedrela odorata*).—Seeds introduced 1938. Several plots established at Waimaro, Waidina and Naduruloulou. The trees have grown well.

## ORNAMENTAL PLANTS.

Many economic plants are also valued as ornamentals for Parks gardens or roadsides—but a number of purely ornamental species have been introduced in the period under review.

1. *Metrosideros tomentosa* (Pohutakawa).—The well known Christmas Tree of New Zealand. A few seedlings were successfully established in 1937 and have made slow progress.

2. *Bauhinia galpini*.—Seeds received from W. L. Wallace, Esquire, of Ba made this beautiful species available locally.

3. *Mussaenda erythrophylla*, *Pogonopus speciosus* and *Miconia magnifica*.—Seeds received on many occasions from Harrison Smith, Esquire, of Tahiti have so far failed to germinate. These would appear to be a highly desirable plants for local gardens.

4. *Cassia alata* var.—Seeds of a new variety of this ornamental shrub received from British West Indies in 1939 gave a few plants from which distributions have been widely made throughout the island.

5. *Sophora tetraptera* (N.Z. Kowhai).—Seeds received in 1937 failed to germinate.

6. Persian Lilac (*Melia azedarach*)—was introduced in 1938 from Malta and many trees planted along roadsides. This tree has long been established in the Colony and is naturalized in the Nadi and Ra districts.

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## THE TREATMENT OF WORMS IN POULTRY.

By

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WITH war conditions causing difficulty in procuring eggs, many householders have turned their attention to "back-yard" poultry farming, as a means of producing a cheap and most valuable source of animal protein. It is regrettable that many such farmers have found by bitter experience that poultry sometimes suffer from diseases, and disease means fewer eggs or even no eggs at all.

One of the main diseases of poultry in Fiji is infestation with worm parasites and it is proposed in this short article to describe the chief worms affecting poultry and methods of treating birds which become infested.

There are two main types of worm: round worms and flat or tape worms. Among the former, the most important to us are the large round worm

(*Ascaridia galli*), the small round worm (*Heterakis gallinæ*) and the gape-worm (*Syngamus trachea*). The tapeworms most commonly found in Fiji are *Choanotænia infundibulum*, *Railletina* spp. and *Davainea* spp.

#### THE LARGE ROUND WORM.

By far the most important of all worms is the large round worm. This parasite infests fowl and may be found in ducks, geese and turkeys, and results in poor development, retardation of the commencement of egg laying and loss of egg production from adult fowls. For its life cycle to be completed it requires damp conditions and consequently it thrives in places where water does not drain away rapidly, especially in the wet season. The adult worm lives in the small intestine and the female deposits eggs which are passed out in the droppings. In the warm moist conditions so frequently found in poultry yards these eggs hatch and produce larvæ which, after undergoing certain changes, are picked up by other birds, swallowed, and after some days spent in burrowing into the wall of the intestine they free themselves and grow to adult worms in the lumen of the intestine.

About ten days after first becoming infested, birds go off their food, the droppings become very fluid, the comb and shanks become pale, the body becomes emaciated, the head and wings start to droop and the birds look typically "sick." Sometimes the appetite remains very good but the birds fall away because they cannot get any benefit from the food. Deaths frequently occur in young birds and even if some do recover the setback prevents them ever attaining full production. Adult birds seldom die but their egg production is always low and they never put on weight.

To determine that birds are suffering from worms it is best to carry out a post-mortem examination on a bird which has died or which appears to be sick. To do this the intestines should be slit open with a pair of scissors and a careful examination made for the presence of worms. These are seen as white wriggling objects from 2 to  $4\frac{1}{2}$  inches long, frequently coiled one around the other and about the thickness of strong thread. An indication that birds are infested can be obtained by noting the pale comb, fluid droppings, emaciation, and in adult birds lack of egg production and—usually—good appetite.

Old birds are resistant to severe infestation but they are never "good doers." Because of this resistance they serve as reservoirs for infestation of younger birds coming on.

#### TREATMENT.

There are two methods of treatment—individual and flock treatment. The former is by far the most effective but also the most difficult, the latter is much easier and much less effective. Individual treatment consists of dosing each bird with a fluid mixture by means of a syringe with a long rubber tube. The mixture is made up as follows:—

Oil of Chenopodium .. .. .	1 part.
Carbon Tetrachloride .. .. .	4 parts.
Liquid Paraffin . . . . .	35 parts.

The dose is as follows:—

Adult birds .. .. .	8 cubic centimetres.*
1 lb birds .. .. .	4 cubic centimetres.
8 oz. birds .. .. .	2 cubic centimetres.

This dose rate should be strictly adhered to as an overdose may prove fatal and it is useful to mark the syringe at the appropriate point so that the correct dose is given. The syringe used should have a metal plunger

\* 8 cubic centimetres = 2 drachms (1 drachm = 60 minims).



but the ordinary ear syringe will do as a makeshift. The rubber tube should be of  $\frac{1}{8}$  to  $\frac{1}{4}$  inch diameter, of stiff rubber (so that it may be passed down the bird's throat) and at least six inches long. The syringe and rubber tube should be filled by inserting the free end of the tube into the mixture and withdrawing the plunger. Air bubbles can be removed by pointing the tube upward and pushing the plunger up.

To dose the bird an assistant holds it close to his side with one hand and opens the beak with the other, keeping the neck stretched. The free end of the rubber tube is passed well over the tongue, to one side of the mouth and down the throat at least three inches (in an adult bird). It can, if the tube is long enough, be passed right into the crop. The plunger is then pressed home.

As can be seen, this process is rather for the experienced poultry farmer than the amateur and it is well known that a syringe is not always available. The alternative is to dose with an ordinary spoon in the usual way but with this method one is never sure of getting the proper dose down, and sometimes it will be poured into the lungs and will asphyxiate the bird. Using the same mixture as before, the dose is one desertspoonful for an adult bird, one teaspoonful for a 1 lb bird and proportionately less for smaller birds.

The flock treatment consists of mixing 2 per cent by weight of tobacco dust into the mash. It can be given frequently—once a day for four days is recommended. The tobacco dust should contain 3 per cent nicotine.† Too little is ineffective and too much decreases the egg yield.

Another method of flock treatment is using 40 per cent nicotine (Black Leaf 40). This is a very toxic substance and care must be used in handling it. It should be mixed in the mash at the rate of 1 drachm to 8 lb of mash. The nicotine is first diluted with  $\frac{1}{2}$  pint of water and this is then *thoroughly* mixed into the mash. It can be given daily for four days, as with tobacco dust. On the fifth day Epsom salts should be given instead of nicotine. The dose rate of Epsom salts is 1 oz. for 12 adult birds.

If this last method is used, it is as well to treat a few birds first and watch results as deaths can easily occur if an overdose of the drug is given.

#### THE SMALL ROUND WORM.

This worm is not so serious as the large round worm. It is found in the caeca or blind gut. It is about  $\frac{1}{2}$  inch long and is often found even in healthy birds.

No satisfactory treatment is known, but it is found that treatment of the large round worm often results in the reduction of the number of small round worms. By getting rid of the large worm the bird's resistance is increased and it can throw off the small worm infestation.

#### THE GAPEWORM.

This worm inhabits the windpipe or trachea of the fowl. It is  $\frac{1}{4}$  to 1 inch long, is red in colour and appears to have two tails. It attaches itself by its mouth parts to the inside of the trachea, leaving its body and tails free in the trachea. When a number of worms are present they occlude the lumen of the trachea to a greater or less extent and because of the difficulty of breathing the birds assume the characteristic attitude called "gaping." This consists of stretching the neck forward and opening the beak and

† A correction should be made in the amount of tobacco dust used according to the amount of nicotine it contains. Local dust has been analysed and found to contain 1.5 per cent nicotine. In this case 4 per cent of the dust was mixed in the mash.

remaining in that attitude for a few seconds. With little experience one can identify gapeworm infestation on sight as no other complaint causes this characteristic symptom.

Treatment for this must be by individual manipulation, and consists of the following:—

A piece of horse hair about 12 inches long is doubled in the middle and the two ends twisted one round the other in a manner similar to rope making. This is held by the free end and thoroughly cleaned in a bowl of methylated spirits. While an assistant holds the bird with the beak open the end with the loop is passed along the tongue, through the larynx and into the trachea. The larynx can be identified as two vertical flaps with a narrow vertical slit between them which opens and closes as the bird breathes. It is situated immediately behind the tongue. The loop should be passed at least half-way down the trachea, and then it is turned between the thumb and finger about six times. This causes the worms to be caught up in the horse-hair and they can be withdrawn. It may be necessary to pass the loop two or three times before all the worms are removed. If the horse-hair is too fine it is advisable to use two or three strands to make it stiff enough to pass through the trachea. The number of worms usually obtained may be from one to seven or eight. The loop should be kept in methylated spirits between each operation.

#### THE TAPEWORM.

This is found in the small intestine and can be searched for in the same manner as for the round worm. It is very variable in length and may be from an inch to a foot or more. It is very similar to a piece of narrow tape in appearance and is white in colour. The eggs from this type of worm are picked up by secondary hosts such as snails, butterflies, beetles, moths, flies, etc., and in the body of these insects they undergo certain changes which render them capable of infesting poultry afresh. Infestation occurs when the insect is eaten by the primary host.

There is very little to be done in treating infestation with this type of worm. Drugs which remove the bodies of the worm will not affect the head, and a new body can be grown from the same head. It is considered, however, that if wet places are avoided and every effort made to clear away the droppings to a place where they are not accessible to insects, the infestation can be controlled to some extent. Where heavy infestation with tapeworms occurs, droppings should be cleared from the pens at least once daily.

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#### CULTIVATION OF THE "KAWAI" (*Dioscorea esculenta*).

By

PENI TURAGA and PENI YAKU  
Native Field Assistants.

THE natives of Fiji regard "Kawai" as one of their oldest known and best liked vegetables. It is not often that many Kawais are available for purchase in the market.

There are a number of varieties, but that known as "Mocevata" is considered the best, being sweet flavoured, large in size and the heaviest yielding.

The most suitable soil is a light friable loam with but little clay in its composition. It should be so well drained as to be rather dry and must be rich in vegetable matter to produce large crops. A warm climate is necessary and although the plant will grow in the mountains up to considerable elevations it thrives best in the hot lowlands where the annual rainfall is about 70 inches. It is however planted widely in both the "wet" and "dry" zones.

The land selected for cultivation should be clean weeded during the first week of August. All vegetation is left to dry out, when it is burned on the land to retard subsequent weed growth. The land is then prepared either by the plough or by hand-forking. When the fork is used, only mounds about two feet diameter are dug for each "set."

When choosing planting material select tubers which are smooth at the end furthest from the old stem. Those tubers having a rough "pimply" skin on this end are not suitable for planting.

The best months for planting are October and November. If planted earlier than October there is usually a high proportion of the inferior "pimply" skinned tubers in the resultant crop. Spacing of the mounds is usually 3 feet by 3 feet and when planted in drills on ploughed land the drills are 4 feet apart.

Planting of the tubers must be carefully watched. The stem-end is placed downward in the soil and the smooth end, referred to above, should be covered by  $1\frac{1}{2}$  inches of soil.

Very clean weeding of this crop is most important as it will not tolerate any competition. Continuous and thorough weeding is necessary throughout the growing period of the crop.

As soon as the young shoots are long enough, they are trained to wind around reeds about 6 feet long, thrust into the ground as stakes.

The crop matures in six to seven months and maturity is indicated by the yellowing of the leaves.

Harvesting is usually accomplished without the use of implements. The base of the stem about ground level is grasped firmly and a steady pull exerted, lifting the mature tubers free of the soil. It is essential that the tubers are not bruised in harvesting as bruised tubers will rot very quickly. Harvest the crop as soon as it is mature otherwise many tubers will develop the undesirable "pimply" skin, and will commence to grow again.

In a good crop one mound may yield up to ten tubers 3 to 5 lb in weight each. The tubers should be lightly brushed clean with the hands and stored in a dry place. Tubers in storage which commence to shoot should have the young shoots rubbed off by hand.

It is possible with care to store Kawaiis for up to six months.

## PREPARATION OF COFFEE AT NAVALA, COLO NORTH.

By

L. HARMAN

Temporary Agricultural Assistant.

COFFEE was first grown at Navala and other neighbouring villages as a "tax crop," probably some fifty odd years ago, to cover provincial rates, and is now to be found growing wild. A few of the natives make coffee in small quantities for their own consumption and the method employed is as follows:—

The ripe berries are gathered and placed in a basin or any such container, filled with water, and the process of removing the pulp takes place simply by squeezing the berries with the thumb and fingers. The water used not only acts as a wash but also determines the good berries from the bad. The undesirable ones rise to the surface and are discarded.

The next process, after the pulp has been removed, is the removal of the outer skin or parchment. This is done by exposing the beans to the sun until the skin practically frees itself.



The roasting follows after the parchment has been removed. A cylindrical container made from thick gauge iron, measuring about 18 inches in length and 5 inches in diameter is used. A crank-shaped handle is attached to one end and a shaft about 4 inches long to the other. The base of the handle and the shaft rest on two wooden forks driven into the ground on each side of a fire place. The forks are set so as there is enough clearance for the cylinder to rotate above the fire when the handle is turned. An aperture in the side of the roaster admits the beans and is closed by a slide shutter. Over a gentle fire the roaster is slowly turned by means of the handle until the required degree of roasting is reached. All that remains is for the roasted beans to be ground in an ordinary coffee grinder, and a delicious and stimulating cup of steaming coffee—not omitting the pinch of salt—is the result.

### TRENCHING.

By

C. M. DASS

Grade A Field Assistant.

TRENCHING is a method of manuring and consists of digging a trench about 1 foot deep, filling it with cowdung, horse manure, waste vegetable matter, etc., and covering it up with earth.

Much has been written, and rightly so, about the sound practice of manufacturing and the use of compost on the farm and the vegetable garden, but little publicity has been given to trenching. Where more permanent results from manuring are desired trenching may be tried.

At Allahabad, in India, trenching has been known to build up extremely poor land into first class farming land, and its beneficial effects were noticeable for over fifteen years. At the General Experiment Station, Sigatoka, a small plot of land was trenched over six years ago, which is still producing excellent crops.

While trenching involves great initial expense and under Fiji conditions cannot be advocated on a large scale, that is, for field crops, most farmers can make use of it in the kitchen garden. Much waste of potential trenching material is taking place on an average cultivator's holdings. Cattle and horse manure is allowed to lie where dropped, leach away by the action of the sun and rain and be lost. Manure is far too valuable to be wasted in this manner.

The method of trenching suggested for small areas such as a household vegetable garden is as follows:—

4 ft.							
4 ft.	A	B	C	D	E	F	G
		N	M	L	K	J	H
	AA	O	P	Q	R	S	T
		Z	Y	X	W	V	U

Mark off the plot of land to be trenched into squares 4 feet long and 4 feet wide as shown in the diagram. Dig B to a depth of one foot and throw the soil on to A. Then fill the trench in B with a mixture of farm-yard manure, plant trimmings, wood ashes, etc. Now dig a similar trench in C and throw the earth over the manure in B, covering it completely. On the following day, or as soon as sufficient trenching material is available, fill C with manure and cover it up with soil dug from D, and so on. N is covered over with soil which was heaped on A. The whole procedure will start again from O. Z will be covered over with soil from O which had been heaped on AA.

If sufficient trenching material is available a little trenching should be done daily. It should not take very much of a farmer's time to dig a trench four feet square, filling it with manure and covering it with earth.

#### ADVANTAGES OF TRENCHING.

1. If properly trenched, manure is placed where it cannot burn out, for it has about 12 inches of soil above it.

2. The digging of the trench is as beneficial as deep ploughing.

3. The manure in the trench decomposes and forms humus which conserves moisture.

4. Trenched land is sufficiently aerated because the strip of humus prevents packing of the soil.

5. Trenching is economical because the manure and other waste matter put into the trench is handled only once.

6. Trenched manure is placed where it is of most use to the growing plant and the unsightly manure heap is done away with. If manure is left lying about on the surface of the ground it breeds flies.

7. The effect of trenching is lasting.

Under intensive cultivation, such as in a vegetable garden, good crops may be produced for five or six years with little further manuring. For field crops trenching will give good results for ten years or more.

#### REFERENCE.

*Trenching* by Sam Higginbottom Baptist Mission Press, Calcutta.

#### CARE OF WORKING ANIMALS.

By

S. BHARAT

Grade B Field Assistant.

IN Europe and America large sums of money are spent annually on the care and breeding of animals for special purposes, in spite of the fact that machinery has replaced animals to a large extent in cultivation and other farm work.

In India the peasant farmers take great care of their working animals; not only do they keep them in sheds, so as to protect them from the weather, but they feed them on some grains and make pets of them and give them special names. The droppings are swept up in the morning, made into cakes and dried, to be used later on as fuel for heat and cooking, because of the shortage of firewood.

Here in Fiji, the Indian peasant farmers either tether their cattle near their dwellings or keep them in small barbed wire enclosures. The former method requires a great deal of rope and breeds flies, which carry disease germs from one place to another, and in the latter, the animals are so crowded that stronger ones may injure the weaker ones and there is not enough rest for them. In wet weather, the ground becomes very muddy and is mixed

with the animals' droppings, and here, after a hard day's toil, the beasts are expected to take their rest and be ready for work in the morning. Under such circumstances one can imagine what the result will be.

If the farmer wants healthier animals, and more and better work done on his farm, he should improve their living conditions. This can be ensured by the construction of shelters which would afford protection from the weather, if not for all his animals, at least for those who are expected to work for him from day to day. The erection of shelters or houses should not involve a great deal of expense since the materials for building (in most cases) can be obtained from the bush.

Before putting up the animals for the night it is advisable to spread dry grass or old rice straw on the floor. This will serve as bedding and absorb the urine. In the morning, when the animals have been taken away for work the droppings together with the wet bedding should be placed either in a compost heap or garden trench.

The cane growers apply artificial fertilizers and also some green manure to the cane fields. Cane being a heavy feeder, the need for organic matter is great.

The rice growers have done practically nothing towards improving their rice lands; but the soil gets a chance to recuperate as rice is only a five to seven months crop and the rest of the year the land lies fallow. Animal droppings in the form of "pen manure" or compost would be very valuable to both the cane fields and the rice fields.

#### SOME ADVANTAGES OF HOUSING ANIMALS.

1. This ensures proper rest, so they can do the work which is expected of them and remain healthy.
2. The compost heap would give the farmer ample manure without extra cost, for from one animal about 5 tons of manure can be made per year.
3. There is a great saving of rope, especially these days when it is so very difficult to procure. If cattle are tethered some distance from the house (as is sometimes done) ropes are stolen, the cattle stray away and at times damage crops for which compensation has to be paid, and neighbourly relations are strained.
4. The animals become more docile and are easily handled by young and old alike.
5. There is some saving in feed, for the fuel which would otherwise be needed for maintaining bodily heat, would go towards building better animals.

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### COPRA NOTES.

COPRA grading was maintained throughout 1944 at Suva and Levuka, increased quantities being forthcoming on account of the recovery trees have made after the "blows" of 1942-43, and the increased interest amongst Fijians and others owing to advances in the price paid.

Grading however discloses continuous deterioration from Plantation to F.M.S. during the year, the proportions at Suva falling from 77 per cent to 53 per cent and at Levuka from 34 per cent to 9 per cent of the total copra offered at these places for grading.

At Savu Savu the deterioration was such that grading ceased early this year and all copra offered in this area is classified as F.M.S.

As regards production, the total production for 1944 to date shows an increase over the previous year of some 15 per cent, which is satisfactory.

—H.R.S.



## AGRICULTURAL NOTES.

**Seed Drill for Rice.**—Mr. Walter Bryant of Nadi has recently imported a "Suntyn" seed drill from Australia for use in sowing rice. The machine is similar to one imported and used by the late Mr. Tarby, formerly manager of the Government Rice Mill, for sowing rice at Navuso on the Rewa River. The machine did its work well enough but the system of planting rice did not prove very successful on the wet area in the Rewa district. Mr. Bryant's machine is a modern one and as he intends to use it in the "dry" zone there is more than reasonable expectation of its use proving successful.

The rice growing industry in Australia, which is probably approaching the 100,000 tons per annum mark, is highly mechanized. Large drills of this type are used for sowing the seed. In an area of about 15 inches rainfall per annum absolute control of the irrigation water on the rice crops is possible. The crops there are harvested with the "Rice Header"—an expensive but very efficient piece of machinery which harvests, threshes, winnows and bags the grain in one operation. Such machinery could not be used in the small rice fields of Fiji but there is scope for the introduction of more mechanical labour-saving devices such as this drill. Mr. Bryant, who has demonstrated his keen interest in the betterment of the rice industry in Fiji over a number of years is to be congratulated on his enterprise.

—D.A.D.

**Cultivator Plough.**—Another new implement of recent importation is the "Sundercut"—a stump jump disc cultivating plough. Mr. H. P. Ragg, of Korolevu Estate, Colo West Province, states that he is very satisfied with the all-round performance of this plough and considers it far superior to the regular type of disc plough for depth of up to eight inches. It is light in the draught, and economical to work. Mr. Ragg has used the implement on very wet land for rice planting which he believes would have bogged down any ordinary type of tractor plough. It is described by the makers as a 10 disc, cultivator plough, and they state: "Two outstanding features are the use of alternate discs of different diameter, set with undercut, and the differential cog jump which allows of a high jump without increase of draught. . . . The two discs of different diameter on each jump arm are set with undercut which gives them a slicing action and thereby reduces draught. The discs cut to a uniform depth."

The arrangement of the discs seems to have a pulverising action on the sod and a fine tilth results. The implement has been used in Australia for many years and during the war years has been introduced into England where it has met much favour among farmers.

—D.A.D.

**Pump Irrigation.**—At the General Experiment Station at Sigatoka, after some disappointing delays a 10 h.p. engine and centrifugal pump have been installed for observation and experimentation of crops under irrigation.

The water is raised from the Sigatoka River some 34 feet vertically and then distributed by gravity in channels and furrows.

The plant consists of a four-inch centrifugal pump powered by a 10 h.p. Tange engine. The pump is less than 10 feet above the mean level of the river, inside a concrete pit, while the engine is about twenty feet above the pump. The pump is delivering probably about 15,000 gallons per hour, and to prevent scouring a three-foot square concrete cistern receives the water and allows it to flow along the channels at a reasonable rate.

The "furrow" or "flood" system of irrigation is apparently satisfactory for field crops such as kumalas, melons, maize, etc., but for mixed garden

areas and nursery rows it is rather cumbersome and difficult to work efficiently. When the piping and fittings are available it is hoped to install the overhead sprinkler system on the garden area. Should the rainfall prove inadequate for the rice crop, supplementary irrigation of the more important rice areas will be possible.

The pump has been operating for only three months, but results are encouraging and it is believed that the scheme will prove to be economically worth while, not only for the peculiar problems of an Experiment Station but also as a commercial farming venture. —C.R.V.

**Grain Winnow.**—The hand-powered "Little Wonder" winnower imported early this year by the Department of Agriculture has proved itself a very valuable small machine, easy to operate and very efficient. Such a machine is invaluable for growers of any class of grain except the very small seeds such as mustard.

Separate sets of grids are supplied for maize and padi rice which are easily changed. With this machine there is no waiting on the vagaries of the weather, and the separation of straw, dust, earth and weed seeds is very efficient.

It is of particular value for cleaning rice padi for seed purposes as it effectively separates the slightly smaller seed of one of the worst weeds of rice fields—muraina grass—from the rice seed. A farmer owning one of these machines could clean his neighbours' crops cheaply and yet at a profit to himself. —C.R.V.

## SPECIES OF *PROMECOTHECA* BEETLES IN MELANESIA.

By

R. J. A. W. LEVER, B.Sc (Hons.), D.I.C., A.I.C.T.A., F.L.S.,  
Entomologist.

SOME years ago certain corrections were made<sup>(1)</sup> concerning one of our blue and orange-coloured Hispid beetles of the genus *Promecotheca* and further information is added here.

In 1927 Maulik described<sup>(2)</sup> a somewhat robust jungle species as *bicolor* but on recent submission to the Director of the Imperial Institute of Entomology for an opinion on its validity the reply was received that this is really a subspecies of *cærulipennis* Blanchard. It is of interest to note that Maulik in a subsequent paper<sup>(3)</sup> omits to list both his own *P. bicolor* and also *P. violacea* Uhlmann described in 1932 from the Solomon Islands. Further, the economic species *P. reichei* Baly is said by Maulik to occur in the Philippines and Solomons which is incorrect while he omits mention of Samoa where it is present<sup>(4)</sup>.

Finally, the distribution of *P. opacicollis* Gestro is given as Solomon Islands which is somewhat deceptive as except for the New Hebrides this species has been recorded only from the Santa Cruz Islands<sup>(4)</sup> which lie 200 miles east of the main Solomon archipelago.

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- (3) Maulik, S.—1937. *Proc. Zool. Soc. Lond. Ser. A*, July, pp. 149-150.
- (4) Lever, R. J. A. W.—1933. *Brit. Solomon Is. Agric. Gaz.* Vol. 1, No. 4, October, p. 11.

## CHEMICAL NOTES.

ALTHOUGH the staff of the laboratory is still far from normal, changing conditions have made it possible to give some attention to investigations which were unavoidably interrupted in 1940.

### SOILS.

Work has proceeded with soils from seven profile studies made by the Agricultural Officer Northern in connexion with rice, tea and cocoa cultivation in Vanua Levu. Mechanical analyses and pH determinations have been completed on 150 samples and a start has been made on the determination of fertility factors. Seventeen samples of soil submitted by the Acting Director (together with field notes) on an area in the Nadarivatu section are nearing completion and a visit was made by the Senior Chemist to Sigatoka Experiment Station and a rapid reconnaissance made of the shallow hill soils on the western boundary of that station.

With increasing field experience it is becoming more and more apparent that many of the soils of the Colony are to a large extent extremely variable in depth, mechanical composition and fertility. The necessity of a general soil survey is therefore a matter of first importance.

With the spare-time assistance of a chemist from the R.N.Z.A.F., work has continued on the investigation of rapid methods of soil analyses particularly in connexion with fertility assessment.

### NUTRITION.

Modern apparatus for the determination of the vitamins by chemical and physical methods has been secured on behalf of the Nutrition Committee. With the assistance of an officer from the R.N.Z.A.F., a chemistry graduate of the University of New Zealand, a study has been made of the potentialities of the equipment in terms of standard vitamin solutions and it is believed that with increasing familiarity the equipment is capable of excellent service. It is hoped shortly, after the completion of preliminary studies, to make a commencement on the determination of vitamin B1 in the rice varieties of the Colony.

### FIJI PLANTS.

Several Fijian plants are reported to contain poisonous principles or to possess medicinal virtue and accordingly as opportunity permits and in line with laboratory facilities investigations are performed on reputable material submitted by the Agricultural Officer South who is a botanist. Work of this nature is of importance both from administrative considerations of witchcraft and abortion practices and also the possible discovery of new and important drugs.

The following plant barks were submitted by the Agricultural Officer South in connexion with a case of abortion: yalu, sasaqila, sirisiri, drala, evuevu, wi and uto dina. Preliminary work has shown the presence of alkaloids in uto dina and evuevu and an alkaloid has been isolated from the latter source.

### CHAULMOOGRA OIL.

The composition of local Chaulmoogra oil has been engaging the interest of the laboratory for some time and recently attention has been directed to the study of a little known component of that oil, namely the phytosterol constituent. The local oil contains about 0.25 per cent of a phytosterol which has been isolated as a beautifully crystalline material melting after purification by modern physical methods at 137° Centigrade. The nature and constitution of this material is receiving attention as is also its medical implications. This work has been carried out by the Senior Chemist in association with Mr. A. I. Biggs, Science Master of the Boys' Grammar School.

—W. J. B.



## VETERINARY NOTES.

### BULLS.

DURING a visit of inspection to the Western side of the island the writer was impressed by the deterioration in the size and quality of the cattle bred for work, milk and beef purposes. This appears to be due to lack of suitable male breeding stock. Prior to the war there were frequent importations into the Colony of bulls from Australia and New Zealand, but with the restriction on transport because of the war, these importations have been greatly reduced.

There is still a great deal of difficulty regarding sea transport, but stock breeders are reminded that it is still quite possible to import good bulls from New Zealand and transport difficulties can be overcome. It is necessary to obtain prior permission from both the Department of Agriculture and the Economic Warfare Office, but in neither case is permission likely to be refused. Export permits would be required from the country of purchase but those who have imported bulls recently report that there is no great difficulty about this.

It is to be remembered also that the Department of Agriculture allows a subsidy on imported bulls to the extent of £10. This amount generally covers the cost of transport hence the bull can be landed at Suva at the same figure as his initial purchase price in New Zealand.

Inquiries are being made by this Department to ascertain the possibility of obtaining transport for bulls from Australia. A further note will be made in this journal when this is arranged.

A young Red Poll bull has recently been imported from New Zealand to replace the old bull at Nasinu Farm. This is available for service on female stock belonging to the public at a very reasonable fee. It is to be remembered that Red Poll cattle are suitable as milk, beef and work animals and therefore should be used more by peasant farmers.

### TAMWORTH BOARS.

Nasinu Farm has for sale some young Tamworth boars. These are from high-class Tamworth sows imported from New Zealand in pig. They are just being weaned at present and will be available to bona fide pig breeders at £3 10s. 0d. Applications for these should be addressed to the Senior Veterinary Officer, Department of Agriculture, Suva.

### MIDDLE WHITE YORKSHIRE BOARS.

The farming community are reminded that Nasinu Farm has available some young boars of the above breed available for sale as breeders. These are of a very good type, from parent stock of proved fertility. Prices can be had on application.

### NASINU FARM MILK AND CHILD WELFARE MILK SCHEME.

The herd of dairy cows at Nasinu Farm has been used for some time now to supply milk to the Child Welfare Scheme which is organized by the Public Health Department.

During 1944 up to 13th November, 2,529 gallons of milk has been supplied from Nasinu, and it is estimated that for the whole year 2,853 gallons will have been supplied.

The cows are milked twice daily, but only the morning's milk is taken for Child Welfare purposes owing to the impossibility of obtaining transport from Nasinu to Suva twice daily. The afternoon's milk supplies the industrial school at Nasinu and any surplus goes to the Rewa Butter Factory as cream.

From the milk supplied to the Child Welfare Scheme, 313 pupils have been supplied with half a pint of milk daily. The pupils are selected by the Child Welfare Nurse who selects according to age (younger children are

given preference), size, health, etc. The following schools are included in the scheme: Girls' Grammar School; St Anne's School; Dudley House, Amy Street; Dudley House, Ewen Street; Annesley House; Wesley School; Miss Corbett's Kindergarten; Miss Edwards' Kindergarten. The milk is collected from the farm by the Health Department's truck and brought to the Colonial War Memorial Hospital where it is pasteurized and bottled in half pint milk bottles. Each bottle is sealed—a special bottling and sealing machine is employed to reduce handling—and the bottles are placed in the freezer for delivery the following day. In pasteurizing, the milk is heated to 170°F. and bottled at 140°F. The new building which has been erected in the Colonial War Memorial Hospital grounds to process the milk has so far not been used owing to the fact that a piece of equipment necessary for the steam heating is unprocurable at present. It is hoped to obtain this in the near future and the whole of the processing will then be carried out in the new building.

The last bacteriological examination of the milk resulted in the following:—

Raw milk .. ..	S.B.C. 190,000
	<i>B. coli</i> absent in 1 c.c. M.Q.T.
Heated milk.. ..	S.B.C. 3,000
	<i>B. coli</i> absent in 1 c.c. M.Q.T.

These figures indicate that the milk is exceptionally clean, both before and after pasteurizing and is well inside the regulation standards of temperate countries.

It is unfortunately not possible to distribute this milk free to all schools and consequently a charge of 1d. per bottle is made. In cases where parents are unable to afford this amount, no charge whatever is made.

—H.T.B.H.

#### FRUIT AND VEGETABLE SUPPLIES IN 1944.

OWING to excessive and continuous wet weather green vegetables were generally scarce and variety limited up to about July when a drier spell enabled English cabbage to mature to a reasonable quality. Tomatoes and melons were adversely affected and the season has been poor for both quality and quantity.

Native root vegetables have been in good supply up to September, when the usual seasonal shortage made itself felt, being enhanced by both short plantings and adverse growing weather.

Guarantees issued by Government for kumalas and other vegetables were not taken up, and that for kumalas still operates, but interest is small.

Prices have not been unduly high considering the vagaries of the season and the continuous and heavy demand from the forces.

Banana plantings have not been maintained and this together with the two "blows" in the early part of the year which affected the Waidina, Wainibuka and Lomaiviti areas particularly, and the lack of care of plantations resulted in a shortage of fruit particularly for export, a shortage which has not yet been eased. With warmer weather however supplies should be more plentiful and if the native planting programme is carried out, greater supplies should be available for 1945.

On the 4th November a system of price control was introduced by the Price Controller, but it remains to be seen just how successful this will be. The quantities of fresh fruit, vegetables and native root vegetables required by the Forces has shown a continuous downward trend, so that at the time of writing weekly deliveries are approximately 36 per cent of the quantity supplied a year previously.

—H.R.S.

# OBITUARIES.

## CHARLES HAROLD WRIGHT.

It is with regret that we record the death on July 31st, 1944, of Mr. Charles Harold Wright, M.A. (Cantab.), F.I.C., the first Government Chemist of the Colony.

With six years previous service in Trinidad, where he was Professor of Chemistry at the West Indian Agricultural College, Mr. Wright was appointed to Fiji in 1914 as Agricultural Chemist the title of his office being altered in 1920 to that of Government Chemist and Analyst.

When Mr. Wright arrived in Fiji the Department of Agriculture was very small and laboratory facilities were meagre. Nevertheless, despite these difficulties which were accentuated by the war of 1914-18 Mr. Wright with characteristic energy developed and maintained a chemical service and laid the foundations and policy of the present institution.

With a comparatively new field of chemistry to be explored Mr. Wright interested himself in a study of natural products such as essential oils, copra, fixed oil and fibres and above all the soils of the Colony. His classical works on the *Alluvial Soils of Fiji* and the *Soils of Fiji* which were published as bulletins of the Department of Agriculture exerted a profound influence on soil management in Fiji particularly in regard to the necessity of liming in the maintenance of fertility.

In the troubled days of 1914-18, with his wide knowledge of Fijian customs and language Mr. Wright was called upon to act on two occasions as District Commissioner and Provincial Commissioner Kadavu and as District Commissioner and Provincial Commissioner Nadroga and Colo West. On two occasions also he acted as Superintendent of Agriculture.

In 1924 Mr. Wright was transferred to Nigeria as Senior Chemist and during his stay in that Colony, from which he retired in 1934, he carried out a general soil survey which played no small part in Land Settlement Schemes.

Mr. Wright although said to be of a retiring disposition took an interest in local affairs. He was for a period Secretary of the Fiji Club and an active member of the old Fijian Society.

On retirement from Nigeria he busied himself with the preparation of two works for which he is widely known and Wright's *Agricultural Analysis* and *Soil Analysis* have become standard laboratory companions to the practising agricultural analyst.

The late Mr. Wright was an Agricultural Chemist of outstanding ability and his work in the Colonial Service will remain as an inspiration to the chemists who have succeeded him in Fiji and Nigeria.

—W.J.B.

## VILITATI VAVAITAMANA.

It is with deep regret that we record the death of Vilitati Vaivaitamana, Native Laboratory Assistant, on 18th August, 1944, at the early age of 35.

Vilitati joined the department in 1927 and was posted as messenger to the Chemical Laboratory where he remained for the whole of his official service, being promoted in due course to the position he held at the time of his death.

When the writer joined the laboratory in December 1929 he was met by his one and only assistant, a tall well built, smiling Fijian and on enquiring the nature of his duties Vilitati replied that he had been taught by the



former Government Chemist to perform many analytical duties, the scope of which seemed incredible to one who had had no experience of his ability. It was not long, however, before it was realised that Vilitati had a gift for analytical work and every opportunity was afforded him to cultivate that gift in the succeeding years.

In 1929 the laboratory was small and understaffed and in consequence Vilitati was called upon to do all kinds of manual duties as well as assisting with analytical work. In setting up apparatus he had the æsthetic sense developed to a high degree and would go to great pains to secure the maximum of neatness and geometrical symmetry. Quite often the Government Chemist would find that a piece of equipment which he had set up had been altered, unobtrusively, by Vilitati in order to satisfy the dictates of neatness.

With the growth of the laboratory during the period 1930 to 1938 Vilitati's duties became more and more those of an analytical assistant with particular reference to foods and soils; moreover with the appointment of additional native staff he had the added duty of directing them in the way they should go in matters chemical.

During the "gold rush" period of 1933-1934 the additional duties of assaying were entrusted to the division and with characteristic energy and under the guidance of the European staff Vilitati quickly mastered much of the technique of gold assaying. During this period long hours of overtime were a feature of chemical activities and, as on all other occasions, he was always the last to leave.

His activities in the Rugby field are well known to residents of the Colony. He represented Fiji against Tonga on two occasions on one of which he was Captain of the team. During the memorable tour of New Zealand by the victorious Fijian team, Vilitati played in every match and was Vice-Captain. On the establishment of the Rugby football team of the Department of Agriculture by Dr. Jack, the obvious choice of Captain was Vilitati and the success of that team was in no small measure due to his able leadership.

He was interested also in wrestling and boxing and on one occasion challenged, unsuccessfully, the heavyweight champion of Fiji. Vilitati was also a bandsman and for several years was a keen member of the band of the Fiji Military Forces.

When Mr. Claude Monckton, a former Adviser on Native Affairs, represented the Government of Fiji at the Australia Exhibition 1941, he took with him Vilitati as one of the two representatives of the Fijian race. Dressed in the colourful uniform of the Fijian Military Forces he was the object of much interest to both Australian people and press.

Vilitati had been in ill health for some fifteen months; nevertheless his death came with something of a shock to the department since it was reported that his health was improving. His funeral was well attended by representatives of the sporting bodies of Suva and his many friends both within and without the department which he served so faithfully.

W. J. B.

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